

Handbook - Interdisciplinary and transdisciplinary research

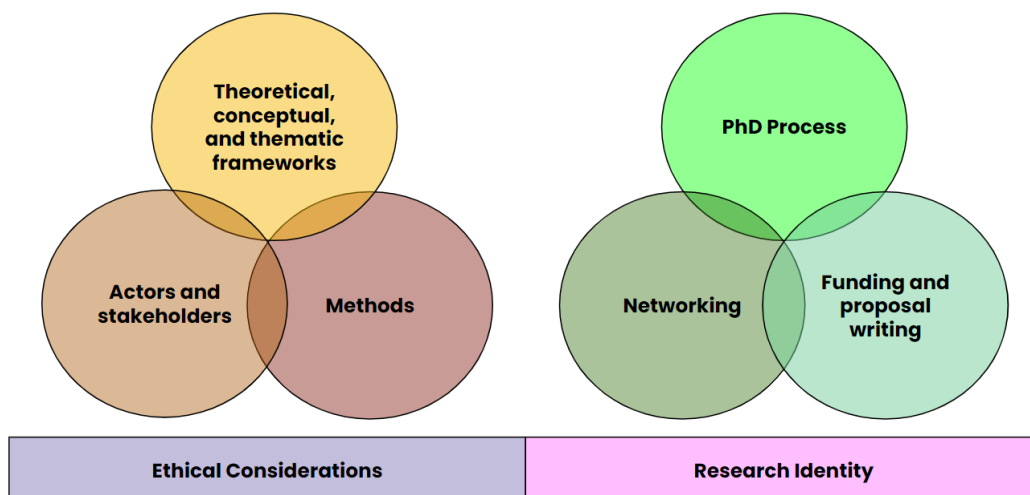
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Main authors: BinBin J. Pearce, Irina Dallo, Hammond Sarpong Antwi
Contributing authors: Erika Angarita, Ana Isabel Garcia Ambrosy, Nadine Brühwiler, Lisa Deutsch, Ancois De Villers, Dena Fam, Jan Freihardt, Stefan Hilser, Lorena Daphna Kuratle, Rebecca Laycock, Jenny Lieu, Philipp Lischer, Nelly Mokay, Stefan Markus Müller, Varvara Nikulina, Pfungwa Nyamukachi, Rea Pärli, Abigail Poeske, Juanita von Rothkirch, Ariane Wenger

Are you conducting or interested in applying or incorporating aspects of interdisciplinary (ITD) and transdisciplinary (TD) approaches into your research projects? If yes, this Handbook provides you answers to common ITD/TD challenges and questions, which should help you to design your project. It should also help you identify with the ITD/TD community, a vital part of the scientific landscape.

The Handbook is a **list of frequently asked questions** about ITD/TD research. The list was compiled based on over fifteen coffee hours with ECSs discussing their challenges and concerns. Some of the answers were jointly elaborated with ECSs and extended with the expertise of the main authors (ITD Alliance ECSs Working group).

The Handbook is a living document, thus further questions that emerge can be added and answers can be expanded with additional insights. We categorized the current questions into eight overarching topics: 1) Research identity; 2) Ethical considerations; 3) Methods; 4) Theoretical, conceptual, and thematic frameworks; 5) Actors and stakeholders; 6) PhD process; 7) Networking; and 8) Funding and career opportunities.



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RESEARCHER IDENTITY

How do I know that I carry out ITD/TD research, and what are the feelings and diverse scopes associated with this type of work?

A distinctive challenge for ITD/TD researchers is that they often have to self-identify as ITD/TD researchers before they can start to find the community which addresses their specific concerns about carrying out ITD research. If you are here reading this piece, in some sense, you have already done the hard part. Welcome!

Interdisciplinary researchers are those who engage in work that requires crossing disciplinary boundaries - you may be here if your supervisors are based in different departments or sections of your institution, for example. You may also be here if you regularly make use of frameworks and theories that span different disciplines. However, this term is applied to researchers who engage in different areas of the natural sciences, as well as those who work between the interfaces of humanities and natural sciences. Julie Thompson Klein and Catherine Lyall have both written extensively about interdisciplinary scholarship. For interdisciplinary scholars, please follow up on their work. For the rest of this section, we will focus on the specific challenge of those who consider themselves to be transdisciplinary researchers.

Transdisciplinary researchers usually work interdisciplinarily and engage with extra-academic actors in the process of their work as well. How this engagement with actors outside of the academic environment is carried out can vary a lot. This is because transdisciplinarity is not just manifested in tools and methods, even though that is the aspect of transdisciplinarity that is often mentioned and implicitly assumed. Rather, transdisciplinarity can be thought of as the combination of any of the following:

Transdisciplinary...

- Settings
- Mindsets
- Processes and practices
- Outputs

Transdisciplinary settings

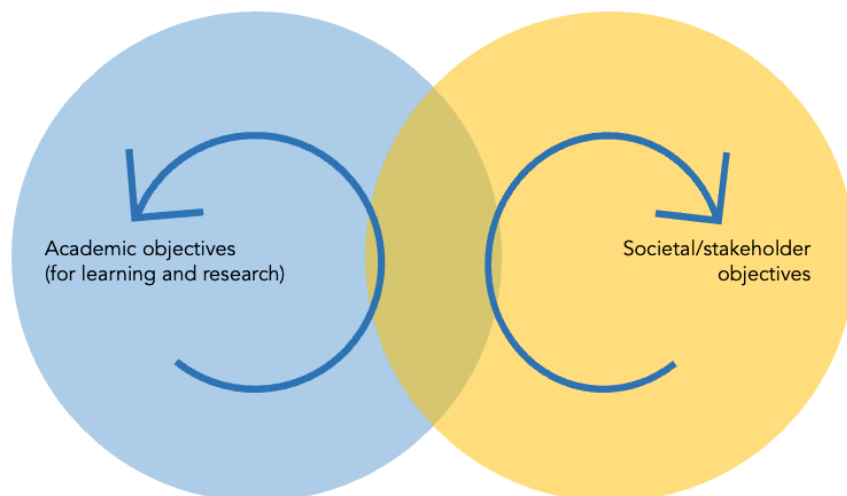


Figure 1: Transdisciplinary setting [adapted from Jahn et. al 2012, Lang et. al 2012, Pohl et. al 2017]

One setting for transdisciplinary work exists in the intersection between academic objectives that exist for both learning and research, as well as societal objectives originating from the needs of those who are outside of

academia. This means that transdisciplinary work is not only motivated by the identification of knowledge gaps within certain fields of academic knowledge, but are also motivated by real-world challenges. Transdisciplinary research from this perspective could be thought of as an interdisciplinary approach to scientific inquiry that deals with complex, real-world problems and places an emphasis on joint problem framing between people inside and outside of academia with the aim of developing possible solutions. A complex or ill-defined problem is a problem that has: 1) an unclear goal definition, 2) unclear goal states, where it is possible that there is no "right" solution at all, 3) unclear means by which to arrive at the goal state and 4) unclear criteria by which to judge whether the goal state has been reached (Rittel and Hortel 1973, Dörner 2017). Joint problem framing (JPF) is a process by which a group with diverging interests, backgrounds and world views comes together in order to make explicit the particular aspect of a complex, real-world problems they would like to solve and to clarify the goal definition, in the context of a research project, where both scientific and practical needs exist. The integration of knowledge and values from different scientific and societal perspectives are needed during the process of problem framing (Pearce and Ejderyan, 2019).

This may be the setting in which transdisciplinary research projects are most often embedded in, but it is not the only setting. In another setting, the focus may be primarily on academic objectives, in which the goal would be to co-produce knowledge that is grounded in a broader set of perspectives and experiences than otherwise would be possible, but the aim of the setting is still to produce academic work. In yet another setting, the focus may primarily be reaching societal goals, with researchers or students as facilitators or reflection partners in the background. The aim here may be that researchers or students learn through accompanying a real-world setting, but the primary goal is not necessarily to produce research based on this involvement or to study the partners they are working with, but as a form of enrichment for specific transdisciplinary capacities that the researchers/students themselves are trying to develop or gain experiences about, while at the same time providing support in a form and manner intended to be helpful to the real-world process itself.

Another setting for transdisciplinary work is when the main focus is set on engaging different ways of knowing (e.g., see Max-Neef, 2005). This means to consider the various ways in which we know the world, how we know it, and what we value within the world. This includes, for example, ways of knowing that are indigenous, spiritual, and artistic, as well as knowledge that comes from experiencing the real world. The goal of such a setting may not be a "solution" to a particular solution, but the process itself helps to create new approaches to creating knowledge, carrying out research, or other types of work that need to be done.

The distinctions between these settings have also been articulated by Pohl (2011). The USYS TdLab website also has a FAQs page that could provide additional perspective (<https://tdlab.usys.ethz.ch/news/faq.html>).

Transdisciplinary mindsets

There are a number of papers and websites which have delineated the attitudes, skills and competencies that are related to transdisciplinary research.

- The [Transdisciplinary Field Guide](#) from Utrecht University recognizes that "an open, curious and adaptive approach to research", questioning personal assumptions, biases and triggers and a capacity to navigate them, and valuing diverse forms of knowledge are important.
- Claremont Graduate University has created [a helpful blogpost](#) that points to boundary crossing, ontological flexibility, focus on interconnectivity and reflective practice as being a part of a transdisciplinary mindset.
- [Guimarães et al 2019](#) provides an empirical study of the motivation, attitudes/skills of individuals and teams who undertake transdisciplinarity.
- [Pearce et al 2018](#) name the ability to frame complex problems and the ability to empathize with diverse points of view as being key skills for transdisciplinary learning and research.

- This [collection of articles in the Humanities and Social Sciences Communications](#) journal all explore aspects of the type of expertise that is needed for integration and implementation for transformative research.
- [Stokols et al 2014](#) discusses the TD intellectual orientation that consists of five categories of personal attributes: TD values for understanding and apply solutions for societal problems, a set of attitudes for integrative scholarship, beliefs that integrating knowledge from diverse fields is important to make academic and practical advances for society, conceptual skills and knowledge for traversing multiple scales and disciplinary perspectives to develop novel ideas, and collaboration skills to work as a part of a team.

Transdisciplinary processes and practices

Some seminal works on transdisciplinary processes include the following texts:

- [Jahn et al. 2012](#) identifies the main features of a conceptual framework for transdisciplinary research for science/science policy.
- [Lang et al. 2012](#) presents a conceptual model of an 'ideal-typical' transdisciplinary process
- [Brandt et al. 2013](#) identifies the main challenges to carrying out transdisciplinary research based on a literature review of case studies in the field.
- Other important publications that are representative of the field can be found [here](#).

In addition to this idealized version of transdisciplinary research process, the following are some concepts that may be linked to transdisciplinary processes and practices.

1. Indigenous knowledge systems (IKS) – Especially noteworthy is their "communitarian" and integrative approach or ethic, which aligns with the foundational principles of transdisciplinary research. African epistemologies, deeply rooted in history, share similarities with transdisciplinary research by emphasising holistic and inclusive methodologies. They underscore the significance of embracing diverse perspectives and various forms of knowledge. Chilisa (2017) emphasises that methodologies rooted in African philosophies challenge academic and methodological imperialism, bringing alternative approaches to research that prioritise problem-solving and inclusive research agendas. These methodologies highlight indigenous and local knowledge (ILK) as a comprehensive body of thought that encompasses all knowledge systems, legitimising ILK holders, practitioners, and communities as scholars and authors of their knowledge and its acquisition.

Chilisa (2017) further outlines three guiding philosophies in African epistemologies—ethnophilosophy, sagacity, and nationalistic ideology—and illustrates their application in research processes:

The evolution of African epistemologies faced significant obstacles due to the impacts of colonialism and slavery. Firstly, these oppressive forces sought to erase or diminish their existence, relegating them to non-existence or deeming them inferior. Secondly, the exploitative practices of scientific institutions towards the Global South and indigenous communities exacerbated these challenges. As Held (2019) notes, natural scientists exploited Indigenous territories for profit, while social scientists studied indigenous peoples from a colonial perspective, often conducting research that was exploitative and disregarded the needs and perspectives of the Indigenous communities. Instances of invasive and unethical research, such as the skin grafting experiments on Inuit in the early 1970s without continuous consent, further exemplify these problematic practices. Similarly, du Plessis (2020) underscores the importance of transdisciplinarity in addressing the socio-pathology of oppression, particularly in post-1994 South Africa, where colonial legacies must be reshaped to meet present challenges. The politics of knowledge production play a crucial role in rebuilding a society disrupted by structural inequality and political disempowerment. Du Plessis emphasizes the need to scrutinize knowledge production histories and institutions to adapt their parameters for change, considering that the global evolution of knowledge shapes the paradigms of local knowledge.

2. **Citizen science** – According to the Green Paper on Citizen Science from the European Commission's Digital Science Unit and Society, citizen science is described as the active involvement of the general public in scientific research activities. This involvement includes citizens contributing to science through intellectual effort, sharing their knowledge, or providing tools and resources. Participants play a crucial role by supplying experimental data and facilities for researchers, posing new questions, and contributing to the co-creation of a new scientific culture (European Commission's Digital Science Unit and Society, 2013).
3. **Systems design and systems thinking** – The systems approach involves a comprehensive analysis of an ecosystem, necessitating the involvement of diverse stakeholders, multiple perspectives, and a range of disciplines to address a problem effectively.
4. **Mode 2 Science** – In the early 1990s, Gibbons introduced the concept of Mode 2 Science, emphasising the idea of "socially robust knowledge." This concept, akin to transdisciplinary research, acknowledges that knowledge is generated for practical application and problem-solving within specific contexts, involving diverse participants. Gibbons advocates: 'A new contract must now ensure that scientific knowledge is 'socially robust' and that its production is seen by society to be both transparent and participative', distinguishing between science and expertise. While mechanisms like peer review maintain the purity of knowledge claims, policy-making requires additional elements such as wisdom, judgement, and expertise. According to Blair (2011), the contemporary challenge lies not in the scarcity of information but in evaluating its validity and usefulness amid the abundance of available data.

Gibbons and colleagues argue that the utility of science may be limited without practical application or use as its outcome, questioning the effectiveness of linear/disciplinary or even transdisciplinary approaches. Mode 2 Science promotes decentralised knowledge production beyond traditional university laboratories, involving a multitude of participants in the research process. This approach allows for diverse and interdisciplinary perspectives, departing from a linear methodology (Gibbons et al., 1994, 1999; Hessels, 2008).

5. **Responsible Research Innovation** – Responsible Research Innovation (RRI) is a relatively new framework that was introduced in the Horizon 2020 European Union funding framework in 2014 which also exhibits transdisciplinary research traits. RRI is defined as: "a process where all societal actors (researchers, citizens, policy makers, business, third sector organisations etc.) work together during the whole R&I process in order to better align R&I outcomes to the values, needs and expectations of European society" (Meijer et al, 2016). RRI thus seeks to incorporate multi-disciplinary and multi-stakeholder approaches to research. Further, RRI encompasses six values that resonate closely with the principles of transdisciplinary thinking: societal engagement, gender mainstreaming in the process, education, open access, ethics and governance.

Further reading:

- Chilisa, B. 2017. Decolonising transdisciplinary research approaches: an African perspective for enhancing knowledge integration in sustainability science. *Sustain Sci* 12, 813–827. <https://doi.org/10.1007/s11625-017-0461-1>
- Du Plessis, H. 2020. Linking transdisciplinary practice to South Africa science, technology and innovation policy. MISTRA. <https://mistra.org.za/wp-content/uploads/2020/05/Working-Paper-Linking-Transdisciplinarity-Practice-to-South-African-Science-Technology-and-Innovation-Policy-Final-Final-280420.pdf>
- European Commission's Digital Science Unit. 2013. Green Paper on Citizen Science.
- Gibbons Michael, Limoges Camille, Nowotny Helga, Schwartzman Simon, Scott Peter and Trow Martin (1994). *The New Production of Knowledge: the dynamics of science and research in contemporary societies*. Sage.
- Gibbons Michael, Limoges Camille, Nowotny Helga, Schwartzman Simon, Scott Peter and Trow Martin (1994). *The New Production of Knowledge: the dynamics of science and research in contemporary societies*. Sage.
- Meijer I, Mejlgaard N, Woolley R, Rafols I, Wroblewsky A. 2016. Monitoring the evolution and benefits of responsible research and Innovation: RRI dimensions and indicators. *OECD Blue Sky III*.

Transdisciplinary outputs

The outputs and effects of transdisciplinary research processes are diverse and go beyond the traditional scientific outputs i.e. journal/peer-review publications. This is because of the diversity of stakeholders involved as well as the real-life problem that TD projects are seeking to solve. TD outputs are often focused on "transformation knowledge", or knowledge of how society can get from where it is to where it wants to be, rather than "target knowledge" (knowledge to set goals) or "systems knowledge" (knowledge of what is there). TD outputs are therefore focused on helping to create change in the real world and can thus be a varied mix that include the following:

- Academic outputs such as scientific journal article, peer-reviewed papers, or presentations at scientific conferences
- Society-directed outreach outputs such as policy briefs, articles in popular media multi-media outputs, presentations at societal conferences/convenings to build awareness around the problem or proposed solutions
- Uptake of knowledge in practice, policy, and science
- Learning: problem awareness and capacity building
- Societal effects: trust building, networks and relationships, inclusion

Further reading:

- Pärli, R., Fischer, M., & Lieberherr, E. (2022). What are the effects of transdisciplinary research projects in the global North and South? A comparative analysis. *Current Research in Environmental Sustainability*, 4, 100180.
- Proclim. (1997). *Research on Sustainability and Global Change—Visions in Science Policy by Swiss Researchers*.

Forum for Climate and Global Change, Swiss Academy of Sciences.

How transdisciplinarity shows up in institutional form

In most places in the world (although this is beginning to change), there is not one department or faculty dedicated to the transdisciplinary approach to research. Instead, specific research groups within various departments may be working with stakeholders or working interdisciplinarily, but they often do not communicate with each other regarding the specific inter- or transdisciplinary aspect of their research. Rather, the academic community within an institution is organized around traditional bodies of expertise shared by specialists in established disciplines.

At TUD, for example, there is a Department of Multi-Actors Systems within a faculty called "Technology, Policy and Management" (established in 1993). Many people in this department have carried out ITD research for years, but would not, until recently, have labeled the research as such. In this institutional context, people take it as a matter of course that stakeholders are involved in the research and that a variety of disciplines must be included in order to address societally relevant issues. The societal relevance of research, by the way, is also assumed to be an important priority. The concept of transdisciplinarity was never, until recently, used to describe its work, however, and therefore, even though much thinking and analysis has been carried out in relation to the design of stakeholder processes, , The role of institutions in technological design, and the importance of having a multi-stakeholder perspective in developing policy and engineering solutions, transdisciplinarity as such has never been studied as a separate category of research.

At ETH Zurich, on the other hand, there is the Transdisciplinarity Lab. In this relatively newly established research group (established 2013), transdisciplinarity as a concept is the focus of research projects, alongside projects that apply transdisciplinarity methods and approaches. The Lab itself distinguishes its work into TD application and TD development (e.g., TD research and study of ITD/TD).

So, depending on where you are working, transdisciplinarity may be an explicit or implicit mode of thinking and doing research, or somewhere in between. No matter where you are, it is helpful to become aware of in what way and for what reason you are considering your own research to be inter- and transdisciplinary.

Reflection from an ECR:

“I realized that the research I had carried out during my PhD could be considered to be transdisciplinary only after a few chapters of my dissertation were already written. I felt both relief and regret that the orientation of my research, which had never seemed to ‘fit’ any discipline, is actually shared by a group of researchers who have experience doing the same type of research that I care about.”

Further reading:

- Jahn, T., Bergmann, M., & Keil, F. (2012). Transdisciplinarity: Between mainstreaming and marginalization. *Ecological Economics*, 79, 1–10. <https://doi.org/10.1016/j.ecolecon.2012.04.017>
- Lang et. al 2012.
- Lieu, J., Martinez-Reyes, A., Groome, P., Mangalagiu, D., Pearce, B. J., Witajewska-Baltvilka, B., & Møller, R.-E. D. (2023). Inclusive stakeholder engagement for equitable knowledge co-production: Insights from the EU’s Horizon 2020 programme in climate change research. *GAIA - Ecological Perspectives for Science and Society*, 32(1), 138–143. <https://doi.org/10.14512/gaia.32.1.11>
- Max-Neef, M. A. (2005). Foundations of transdisciplinarity. *Ecological Economics*, 53(1), 5–16. <https://doi.org/10.1016/j.ecolecon.2005.01.014>
- Pearce, B. J., & Ejderyan, O. (2020). Joint problem framing as reflexive practice: Honing a transdisciplinary skill. *Sustainability Science*, 15(3), 683–698. <https://doi.org/10.1007/s11625-019-00744-2>
- Pohl, C. (2011). What is progress in transdisciplinary research? *Futures*, 43(6), 618–626. <https://doi.org/10.1016/j.futures.2011.03.001>
- Pohl, C., Krütli, P., & Stauffacher, M. (2017). Ten Reflective Steps for Rendering Research Societally Relevant. *GAIA - Ecological Perspectives for Science and Society*, 26(1), 43–51. <https://doi.org/10.14512/gaia.26.1.10>
- Misra, S., Stokols, D., & Cheng, L. (2015). The Transdisciplinary Orientation Scale: Factor Structure and Relation to the Integrative Quality and Scope of Scientific Publications. *Journal of Translational Medicine and Epidemiology*, 3(2), 1042. <https://escholarship.org/uc/item/3mq652fp>

Why might I want to deepen my knowledge about ITD/TD research?

The list of reasons here highlights why it can be vital to enhance one’s knowledge about ITD/TD research in order to solve societally relevant, wicked problems:

- You want to learn from other researchers who also work with stakeholders on a regular basis in order to facilitate workshops and research processes such that the outcomes are satisfying for both those who are societal actors and researchers.
- You want to know about (validated) tools and methods to use for carrying out research that actively involve stakeholders and are both scientifically robust and empowering for all those who participate.
- You would like research processes and outcomes you are a part of to contribute to solving complex problems in society.
- I like to apply the knowledge I gain during the PhD/course of study to a problem that I can help to solve.
- I have a problem I really want to solve for a community I am a part of or have a connection to and research offers me the means and freedom to explore out-of-the box approaches.
- I like working both within and outside of academic settings to develop a more well-rounded view of the problem at hand.
- I am interested in creating new perspectives in research by learning from people whose views may not yet be included in research.

ETHICAL CONSIDERATIONS

What are the ethical considerations when conducting TD/ ITD research?

Ethics in ITD/TD research is crucial in terms of data collection, processing, and sharing, as well as the translation into societally relevant information that enables evidence-based decision-making. Thereby, a distinction is made between internal and external (research) ethics (ALLEA, 2013).

Internal ethics refer to good research practices. In particular, in inter- and transdisciplinary research efforts, open science is key to ensuring the co-production and sharing of both scientific and societal knowledge. In simple words, this means that science should be transparent and accessible (UNESCO, 2022), following the FAIR principles: Findability, Accessibility, Interoperability, and Reuse (Wilkinson et al., 2016). Repositories allowing to make data open are for instance: [GitHub](#), [Zenodo](#), [OSF](#), and institutional repositories (e.g., [ETH research collection](#)). Moreover, to reduce reporting and publication bias, it is recommended to pre-register your planned studies, which is possible here: <https://doi.org/10.24449/FG-2020-00009>; a distinction between confirmatory and exploratory research is possible.

Further, when assessing data from stakeholders including professionals and the general public, it is important to comply with the General Data Protection Regulations (GDPR; [EU's data privacy and security law](#)). It is therefore recommended that ethical approval be obtained when conducting focus groups, surveys, or workshops, for example. This ethical approval should contain clarifications regarding informed consent and debriefing, data protection and publication, possible risks and countermeasures, and intended compensation.

External ethics refer to the relations between science and society, which has a long history. In particular, after World War II, several ethical standards have been implemented especially to avoid misuse of scientific findings and inventions (Evers, 2001). Further, when communicating scientific information to specific target audiences, it is important to make sure that they correctly understand it and can take appropriate actions (Marti et al., 2022). Thus, the responsibility of institutions does not end with simply providing some kind of information but also supporting stakeholders in using it in their decision-making. Thereby, it is important to consider that "..., scientific evidence competes in democratic decision-making processes with other kinds of considerations, including societal values, strategic goals, and social norms" (Freiling et al., 2023, p. 230). As an ITD/TD researcher, one should thus critically reflect on his/her responsibility towards society, legal boundaries and consequences, the potential misuse of data, and his/her role as a scientist in societal developments (ALLEA, 2013). Since in TD research societal stakeholders are actively involved, the expectation is there to give something back to them, which is also an ethical question (i.e., principles that people who are/ will be affected by the impacts should be involved in scientific processes). Sometimes compromises have to be made, for example, by not tolerating the spread of misinformation (measures to remove it from platforms) while at the same time having to restrict freedom of expression.

Links to practical ethics guidelines:

- [Ethics Education in Science](#)
- [Code of Conduct for Scientific Integrity](#)
- [Ethics of AI](#)
- [What is ethics in research & why is it important?](#)

For further reading

- Dallo, I., Herrmann, M., Supino, M., Bayona, J. A., Khawaja, A. M., & Scaini, C. (2023). The need for open, transdisciplinary, and ethical science in seismology. *Seismica*, 2(2).<https://doi.org/10.26443/seismica.v2i2.470>
- Evers, K. (2001). Standards for ethics and responsibility in science. *The Standing Committee on Responsibility and Ethics in Science (SCRES)*, 149.
- Marti, M., Haslinger, F., Peppoloni, S., Capua, G. D., Glaves, H., & Dallo, I. (2022b). Addressing the challenges of making data, products, and services accessible: An EPOS perspective. *Annals of Geophysics*, 65(2), 2. <https://doi.org/10.4401/ag-8746>

METHODS

What ITD/TD methods are available, how can they be applied, and what criteria should be considered when selecting a method that aligns with my specific context?

There are a variety of toolboxes with ITD/TD methods that can be consulted to find a method to address one's research question, to improve teamwork and team building (also taking into account different attitudes and worldviews), and to reflect on one's research approach. A landscape of toolkits for Inter- and Transdisciplinary Research is accessible here: [Overview-toolkits-for-ITD-research_2023-10-31.pdf \(itd-alliance.org\)](#).

When selecting and applying a method, it is important to know that it can be adapted to a specific context to fit the existing circumstances. Pearce et al. (2022) provide the steps that are needed to choose the 'most suitable' method (activity) and adapt it to a specific context, and illustrate with practical examples how such processes can look like:

- 1) **Selecting the overall theme** for the stakeholder interaction
- 2) **Framing the theme** for the stakeholder interaction
 - a) Diversify the modes of participation
 - b) Foster empathy between stakeholders
 - c) Facilitate the ongoing decision-making process
 - d) Encourage future dialogue between science and society
- 3) **Selecting activities** for the stakeholder interaction
- 4) **Adapting activities** to the context of stakeholder interaction
- 5) **Activating reflection** for stakeholder interaction

There exists an ITD Alliance working group that focuses on toolkits and methods, thus you can find their current efforts here: https://itd-alliance.org/working-groups/toolkits_methods/. In the following, a list with existing toolboxes [not exhaustive].

- [Td-net toolbox](#): provides methods and tools specifically focusing on jointly developing projects, conducting research, and exploring ways to impact heterogeneous groups.
- [SHAPE-ID Toolkit](#): provides tools and resources to make informed decisions about interdisciplinary and transdisciplinary research with arts, humanities and social sciences, the sciences, technology, engineering and mathematics, and societal partners.
- [Participatory methods](#): provides resources to generate ideas and action for inclusive development and social change.
- [Action Catalogue](#): is an online decision support tool that is intended to enable researchers, policy-makers, and others wanting to conduct inclusive research to find the method best suited for their specific projects.
- [Becreate](#) - Gestalte dein Projekt [only in German]: How to design your projects, define milestones, and foster creativity.
- [Toolbox Standortentwicklung](#) [only in German]: With this toolbox, the two regional development associations (REV) present best practices and instruments for inner development processes. They also point out where municipalities can obtain support. The toolbox as a web platform contains, in addition to the classical spatial planning instruments, suggestions for municipal and district authorities for planning and designing spatially relevant development processes.
- [TeRRIFICA Toolkit](#): The TeRRIFICA Guide on engagement and co-creation aims at fostering stakeholders' engagement and co-creation within the context of climate mitigation & adaptation. This guide provides some (non-)prescriptive ideas, recommendations & methodologies. They are a "starting point" to help stakeholder engagement & co-creation processes within climate change policymaking in the pilot regions. It disseminates "good practices", i.e. some methodologies and experimentations that may be transferable to other regions in Europe.

For further reading

- Pearce, B. J., Dallo, I., Choi, V., Freihardt, J., & Middel, C. N. (2022). Forks in the road: Critical design moments for identifying key processes in stakeholder interaction. *GAIA-Ecological Perspectives for Science and Society*, 31(4), 222-230. <https://doi.org/10.14512/gaia.31.4.6>

- Djinlev, V., Dallo, I., Müller, S. M., Surchat, M., von Rothkirch, J., Wenger, A., & Späth, L. (2023). Challenges and strategies in transdisciplinary research – early career researchers’ perspectives. *GAIA-Ecological Perspectives for Science and Society*, 32(1), 77-212. <https://doi.org/10.14512/gaia.32.1.16>

What challenges do we face when implementing ITD/TD methods and how can we tackle them?

The often neglected final step is reflecting on the implementation of the method and what could be done better; or at least these reflections are not publicly documented. The table below highlights the challenges faced by both Early Career Researchers (ECRs) and senior researchers during their implementation of methods, accompanied by recommendations for averting these issues in one's own research efforts. While certain challenges and recommendations may seem trivial, the simplicity of certain aspects is frequently overlooked when attempting to grasp the entire context and so forth.

Method	Challenge / Mistake	Advice to make it better
Survey	I forgot to mark some questions as mandatory, which meant I lost valuable data for certain analyses.	Make sure to verify, especially after making pre-testing adjustments, that the relevant questions are programmed as mandatory.
Survey	I implemented the survey in Unipark before having the final questions. I lost a lot of time, having to adapt all the questions again after the pilot test.	Finalise the survey (question formulations, answer scales, order) in a Word or similar document, before implementing it in the online software.
Survey	I did not randomise the survey questions. Hence, I cannot rule out a question order effect.	Think ahead of time and randomise survey questions and/or survey items, if you think that the order of answering could affect participants’ answers.
Surveys [longitudinal studies]	I analysed variables from different surveys where the answer scales were different.	Think ahead of time and use the same scales if you are thinking of comparing variables.
Descriptive analysis in Excel	I completed the entire analysis in a .csv file and unfortunately lost it upon saving, as .csv files only retain a single sheet.	Use Excel (.xls files) and not .csv files to do your qualitative analysis.
Literature review	I had limited access to publications and datasets.	Reach out to the authors of the article or a colleague from another institution you know has access.
Focus Group	I planned to conduct focus groups with 4-5 people. Several participants canceled at the last minute and, thus, some focus groups had only a few participants (2-3 persons)	Invite at least one more participant than you plan to have in your focus groups, in case someone cancels at the last minute.
Framing experiment	I conducted a framing experiment but forgot to add a control group (participants who are not exposed to any frames). Thus, it was hard to conclude if all frames influenced participants’ opinions in the same direction or if they had no effect at all.	When conducting a framing experiment, make sure to use a control group, which is not exposed to any frames.
Joint Problem Framing / Soft Systems Methodology	I facilitated a collaborative Problem Framing Process in a workshop, using Soft Systems Methodology tools. When suggesting that stakeholders compose root definitions in groups, they predominantly designated individuals who were not present at the table as agents of change. Consequently, these individuals did not recognize themselves as potential agents of change. Post-workshop, interest in the Joint Problem Framing dwindled, with half of the stakeholders losing engagement.	In Joint Problem Framing, stakeholders benefit from aligning themselves with both a) the issue at hand and b) potential roles as agents of change. When facilitating group discussions on change strategies, such as crafting root definitions, fostering this identification can be achieved by mandating each participant to be included in at least one proposed measure or, in this context, a root definition.
Design Thinking: Ideation	During an ideation exercise with strict time limits, certain participants struggled to keep up with the pace for improving the written ideas of their colleagues. This resulted in frustration among some of	In a process involving diverse participants, employ a variety of methods that cater to different forms of expression, such as speaking, debating, writing, and drawing. Additionally, incorporate flexibility in

	the participants.	timing to make justice to the needs of participants. These two measures can enhance inclusivity not only in Design Thinking but also in other design methodologies.
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How can we determine what is a legitimate approach, while doing ITD/TD research?

Each discipline has its own convention of motivation for research, methodology, the type and amount of evidence required for creating knowledge, the view of objectivity, the degree to which science must acknowledge scientists' values, the degree to which the phenomenon is amenable to decomposition, and the role that science has in policy and other institutional structures for change (Eigenbrode et al., 2007). Therefore, depending on the views and backgrounds of your supervision committee (if you are doing your PhD), or fellow collaborators with whom you are carrying out research, it is necessary to have an explicit discussion with them regarding these topics before deciding on a particular set of frameworks, methodologies or methods to incorporate into the research.

A legitimate approach for conducting ITD/TD research involves addressing the research questions at hand in accordance with the scientific expectations of the involved parties, rather than strictly adhering to predefined ITD/TD approaches. Further, identifying the scientific paradigm in which your research is embedded and how it differs from others might help you understand why some research types are considered valid by some and not others. For instance, why do some scientists see reality as objective and others as constructed? This can also prepare you to relativize others' critiques when they challenge the legitimacy of your approach to research.

For further reading

- Eigenbrode, S. D., O'rourke, M., Wulfhorst, J. D., Althoff, D. M., Goldberg, C. S., Merrill, K., Morse, W., Nielsen-Pincus, M., Stephens, J., Winowiecki, L., & Bosque-Pérez, N. A. (2007). Employing Philosophical Dialogue in Collaborative Science *BioScience*, 57(1), 55–64. <https://doi.org/10.1641/B570109>
- Horn, A., van der Meij, M. G., Willems, W. L., Kupper, F., & Zweekhorst, M. B. (2022). Developing interdisciplinary consciousness for sustainability: using playful frame reflection to challenge disciplinary bias. *Sustainability: Science, Practice and Policy*, 18(1), 515-530. <https://doi.org/10.1080/15487733.2022.2095780>

THEORETICAL, CONCEPTUAL, AND THEMATIC FRAMEWORKS

What is the difference between transdisciplinary research and participatory action research?

TD research is a subset of a range of participatory research approaches, as is participatory action research. We define TD research as including a joint problem framing phase, with knowledge production as the main aim. Approaches like citizen science, community-based participatory research, and action research are other examples of participatory research. One distinction between these approaches might be their ultimate objectives. For community-based participatory research and action research, the aim may be the transformation of the status quo.¹

In terms of methods used, action research (including participatory action research) and transdisciplinary research have much in common. They use the same methods to a different extent and sometimes for different purposes (Laycock Pedersen et. al, forthcoming).

¹ <https://tdlab.usys.ethz.ch/news/faq.html> [22.12.2023]

An example of differences was analysed in the context of transitioning towards sustainable mobility (Nikulina, 2023). Research on planned transitions shows that transitions require flexibility: space for reflection, learning, and process improvement (Broman & Robèrt, 2017). Both action research and transdisciplinary research offer that, but with some nuances. Figure 2 below illustrates some of these nuances:

Action research	Transdisciplinary research
<ul style="list-style-type: none"> - Reflection upon a particular action - Problem-solving through useful and actionable knowledge production - Focus – problem space - Work closer with local communities - <i>Action-for-knowledge</i> - Contexts where action is a priority 	<ul style="list-style-type: none"> - Reflection upon work approach - Systems approach analysis - Problem-solving approach - Focus – domain - Work closer with government departments - <i>Knowledge-for-action</i> - Advisory reflective contexts

Figure 2: Nuances between action research and transdisciplinary research²

For further reading

- Broman, G. I., & Robèrt, K.-H. (2017). A framework for strategic sustainable development. *Journal of Cleaner Production*, 140, 17–31. <https://doi.org/10.1016/j.jclepro.2015.10.121>
- Nikulina, V. (2023). *Scaffolding for multistakeholder dialogue-based processes in strategic planning for transitioning to sustainable mobility* [Doctoral dissertation, Blekinge Institute of Technology]. <https://bth.diva-portal.org/smash/record.jsf?pid=diva2%3A1753536&dswid=6571>

ACTORS AND STAKEHOLDERS

What is our role as a researcher in TD/ITD projects when involving actors and stakeholders?

As TD/ITD researchers, we often have different hats on, and we need to be able to switch between these roles. A good guide to understanding which roles we need to be able to take over is provided by Fazey et al. (2018). We briefly summarize these roles here:

- **Process facilitator:** Coordinating the learning processes which involves initiating and selecting participants and locations, and designing social engagement.
- **Knowledge broker:** Mediating between diverse perspectives and reconciling contextual and normative views on for instance, sustainability.
- **Change agent:** Involving active participation in learning processes or short-term actions to address real-world issues, as well as motivating and empowering participants.
- **Experts in learning:** Supporting practitioners and scientists in enhancing their learning and research abilities, including aiding in the design of data collection and analysis processes, and promoting reflexive practices.
- **Reflective scientist:** Involving core research activities, like reflecting on improving the collection, analysis, interpretation, and reporting of data from an observer's standpoint, aligning with discipline-specific quality criteria, and ensuring the reliability of findings.
- **Self-reflexive scientist:** Engaging in self-reflection, employing reflexive processes to critically assess their influence on research, action, and learning. This includes evaluating how their epistemological,

² Nikulina, Varvara. 2023. 'Scaffolding for Multistakeholder Dialogue-Based Processes in Strategic Planning for Transitioning to Sustainable Mobility'. Doctoral dissertation, Karlskrona, Sweden: Blekinge Institute of Technology. <https://bth.diva-portal.org/smash/record.jsf?pid=diva2%3A1753536&dswid=6571>
Laycock Pedersen, R., Nikulina, V., Chineme, T., Subroto, S., Robinson, Z., Winkler, K., ... Bhurekeni, J. (n.d.). Distinguishing transdisciplinary (and) action research in sustainability science: a comparative systematic-narrative hybrid literature review. Retrieved from <https://urn.kb.se/resolve?urn=urn:nbn:se:bth-24437>

ontological positions, norms, values, concepts, methods, and paradigms impact the understanding of change and their role in reinforcing and influencing the systems targeted for change.

- **Reflexive facilitator:** Serving as a critical friend by fostering reflexive practices in others and posing critical questions to maintain high ambitions for transformative change.
- **Project manager:** Functioning as a project manager for action-oriented research projects, overseeing coordination and steering efforts to achieve project goals.

Bammer et al. (2023) created a further framework to comprehend which skills we, as ITD/TD researchers, must possess. The defined six characteristics represent the capabilities to employ discipline-based knowledge in transdisciplinary problem solving (see Figure 3).

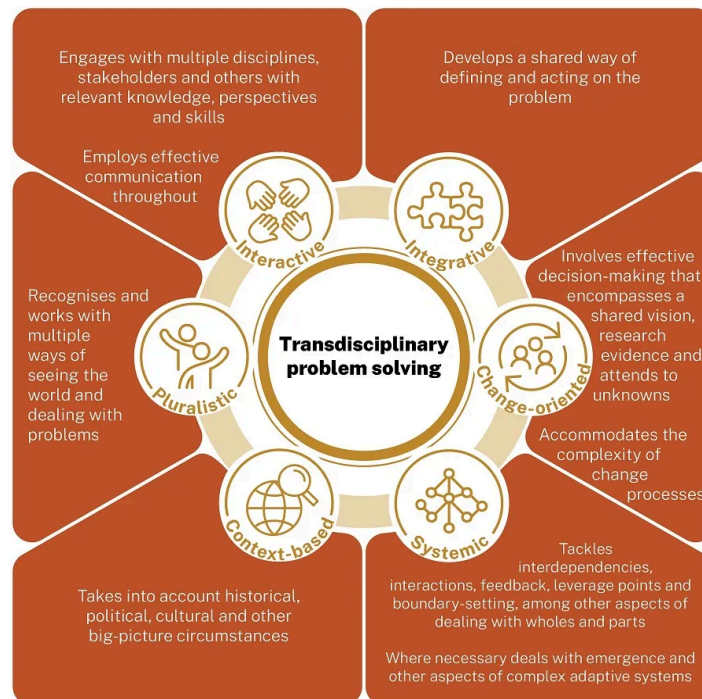


Figure 3: The Australian National University (ANU) framework for transdisciplinary problem solving (Bammer et al., 2023)

Reflection from an ECR:

"I found Haider et al.'s (2018) description of epistemological agility and methodological groundedness very useful to clarify my positioning and to build on my strengths while recognizing my blindspots. This helped me to not get "lost" in the complexity, as well as maintain a sense of rigor in research practice."

For further reading

- Bammer, G., Browne, C. A., Ballard, C., Lloyd, N., Kevan, A., Neales, N., Nurmikko-Fuller, T., Perera, S., Singhal, I. and van Kerkhoff, L. (2023). Setting parameters for developing undergraduate expertise in transdisciplinary problem solving at a university-wide scale: A case study. *Humanities and Social Sciences Communications*, 10: 208. (Online – open access) (DOI): <https://doi.org/10.1057/s41599-023-01709-8>
- Fazey, I., Schöpke, N., Caniglia, G., Patterson, J., Hultman, J., Van Mierlo, B., Säwe, F., Wiek, A., Wittmayer, J., Aldunce, P., Al Waer, H., 2018. Ten essentials for action-oriented and second order energy transitions, transformations and climate change research. *Energy Research & Social Science* 40, 54–70.
- Haider, L.J., Hentati-Sundberg, J., Giusti, M., Goodness, J., Hamann, M., Masterson, V.A., Meacham, M., Merrie, A., Ospina, D., Schill, C., Sinare, H., 2018. The undisciplinary journey: early-career perspectives in sustainability science. *Sustainability Science* 13, 191–204. <https://doi.org/10.1007/s11625-017-0445-1>

How do you handle situations where your collaborator or supervisor has a different perspective on the definition of "science" compared to yours?

Collaborating with supervisors who have diverse backgrounds and interests can either be a challenge or a blessing. Perhaps, the key to establishing a productive working relationship with them may lie in understanding their varying interests and perspectives, but it is also crucial to acknowledge that differing perspectives are a norm in the field of science, often leading to valuable discussions and new insights. However, if deep differences exist between the viewpoints held by you and your supervisors or collaborators, that could significantly impact your work. To get to know each other and figure out how to work together for the greater good of your research and project, you'll need to have an open, honest, and professional discussion. Here, we present four points to consider in this regard:

- **Understand their perspectives and share your perspective:** After you have listened to their viewpoint, share your own perspective on what you believe constitutes science. Be clear and concise in explaining your understanding and why you hold that viewpoint. Use evidence and examples to support your perspective.
- **Seek common ground and respect differences:** Look for areas of agreement or common ground between your viewpoints. It is often possible to find shared principles or goals that can help bridge the gap. However, it is also important to acknowledge that different people may have different philosophical or methodological approaches to science. Respect their viewpoint, even if you don't agree with it, and avoid making value judgments or dismissive comments.
- **Ask Questions:** During meetings, don't hesitate to ask questions to clarify uncertainties. You can also ask for additional references when the perspectives offered by your supervisor differ from yours. Delve into these references to understand their viewpoints and for you to also be certain of your viewpoint. Science is a changing field, asking questions or probing deeper through references and further reading is key to staying updated.
- **Consult others:** Seek input from other colleagues or mentors who may have experience with similar situations. They can provide valuable insights and guidance on how to navigate the differences in viewpoints and also engage with your supervisors under such conditions.
- **Focus on goals and long-term compatibility:** Keep the ultimate goals of your collaboration or research in mind. If your differing viewpoints do not significantly impede progress toward those goals, it may be possible to work together effectively despite the differences.

Reflections from a ECRs: *"My supervisors allowed me to carry out research that crossed traditional academic boundaries in my field of study. This came, however, with a series of discussions and justifications for the methods being used. My final research accomplishment came from my determination to ask questions to gain insight and internalize the concepts I was applying, meaning, don't just embark on a transdisciplinary pathway; more importantly, understand what you are picking up towards such a journey."*

PhD PROCESS

What should I consider in the first year of my PhD?

Starting a PhD in ITD/TD research can be particularly challenging since it involves collaboration across traditional disciplinary boundaries to address complex problems. Here is some advice for your first year in a PhD program:

- **Understand Transdisciplinarity:** Gain an understanding of what ITD/TD entails. Read literature and look at case studies to grasp the principles of working across disciplines. Attend courses/classes on TD if available at your institution/university.

- **Interdisciplinary skills:** Identify the key skills and knowledge fields from the disciplines relevant to your ITD/TD research and then acquire these skills through coursework, workshops, summer/winter schools, or self-study.
- **Research proposal:** Develop a research proposal that clearly outlines the TD nature of your project, including the involved disciplines and impact of your research (e.g., 10 reflective steps to render your research societally relevant, see references below).
- **Advisor selection:** Often you have the chance to choose a second advisor (besides your main supervisor). Choose an advisor who has experience in transdisciplinary research or a discipline relevant to your project where you have less knowledge.
- **Networking:** Build a network within and beyond your institute by attending ITD/TD seminars, conferences, and workshops.
- **Follow your peers (on social media):** Follow leading scientists in your field on social media (e.g., LinkedIn, X (formerly Twitter)) to follow their research and projects and learn about webinars, workshops, and summer schools, for example.
- **Seek guidance:** Seek guidance and tips and tricks from peers who are already further along in their PhD journey. A suggestion is to build a doctorate support group among you, PhD students, and meet once a month to update each other, share struggles, and discuss challenges you face.
- **Flexibility and adaptability:** Be prepared to adapt your research approach as you encounter new opportunities to involve societal stakeholders or some stakeholders may not have the time and resources to contribute to the project.
- **Take and Keep Note:** Taking notes from literature is invaluable as your work evolves. Taking notes is one thing, and keeping them is another. Investing significant time in reading literature is disheartening, only to lose it, especially in your third or final year. Creating a repository of self-generated materials to consistently refer back to is what will ultimately shape your final output.
- **Time Management and Planning:** Develop effective time management and project planning skills. Create a research timeline, set milestones, and establish a daily or weekly routine that allows for consistent progress in your work.
- **Reflection and integration:** Regularly reflect on the integration of knowledge from different disciplines in your research and how it shapes your outcomes.
- **Develop strong communication skills:** A strong skill will be needed to bridge gaps between disciplines. You'll need to explain your research to audiences with varying levels of familiarity with your subject matter. Tailor your communication to be accessible to both experts and non-experts, using clear language and visual aids when necessary. Effective communication will be key in conveying the significance of your transdisciplinary research to a broader audience.

Embrace the opportunity to work at the interface of different disciplines and stay open to new ideas and perspectives that shape your research efforts. Your first year is a foundation-building phase that will set the stage for your PhD journey.

For further reading

- Do the *Ten Reflective Steps for Rendering Research Societally Relevant* developed by Christian Pohl, Pius Krütli, and Michael Stauffacher to identify the societal relevance of your work and reflect about the stakeholders' perspectives. <https://www.ingentaconnect.com/content/oekom/gaia/2017/00000026/00000001/art00011;jsessionid=f6ap3c83nf8tj.x-ic-live-01>

What should I keep in mind in the final year of my PhD?

The last year of a Ph.D. program is typically characterized by a combination of intense work, a focus on completing the dissertation, and insecurities about future steps. Here are some key things to keep in mind during this phase to help you successfully navigate it:

- **Stay focused on your dissertation:** Your primary focus should be on completing and polishing your dissertation. Dedicate a significant portion of your time to writing, revising, and editing.
- **Set clear goals and milestones:** Create a detailed timeline with specific milestones for each chapter or section of your dissertation. This will help you stay organized and make steady progress.
- **Prepare for your dissertation defense:** Understand the requirements and expectations for your defense. Practice your presentation and anticipate questions from your committee.
- **Review graduation requirements:** Ensure you understand and fulfill all the graduation requirements set by your university. Address any administrative tasks or paperwork promptly.
- **Maintain regular communication with your advisor:** Keep your advisor updated on your progress and seek their guidance when needed. They can provide valuable feedback and support, you are not alone.
- **Seek support:** Do not hesitate to seek support from your peers, mentors, or counseling services if you are feeling overwhelmed or stressed.
- **Publish and present your research:** Think about publishing your research in academic journals or presenting it at conferences in your field. This not only contributes to your field and enhances your academic profile but also fosters the growth of interdisciplinary research output.
- **Network and collaborate:** Attend conferences and seminars to network with peers and potential collaborators, where you could imagine to continue working. Collaborations can lead to research opportunities and job prospects.
- **Consider career plans:** Start planning for your post-Ph.D. career. Explore different career paths, update your CV, and attend job fairs or workshops on career development.
- **Balance work and life:** While the final year can be intense, make sure to take breaks, maintain a healthy work-life balance, and prioritize your well-being. It's crucial for both productivity and overall well-being.
- **Manage stress and self-care:** PhD completion can be stressful. Practice self-care strategies such as exercise, mindfulness, and seeking support from colleagues, friends, and family.
- **Be flexible:** Research may not always go as planned. Be prepared to adapt to unexpected challenges and changes in your project.
- **Reflect on your journey:** Take time to reflect on your academic journey, the skills you have acquired, and your personal and professional growth.
- **Make a decision and go with it:** Sometimes we are undecided and do not know which path to take (e.g., to stay in academia or not). Dare to take a path, there is always the possibility to change again.
- **Celebrate achievements:** Acknowledge and celebrate your accomplishments along the way, whether it's completing a chapter or receiving positive feedback.

The final year of your Ph.D. is both a demanding and rewarding period. By staying organized, seeking support when needed, and keeping your long-term goals in mind, you can navigate this phase successfully and set the stage for your future career.

Reflections from an ECR: *“Finishing a PhD is like starting—there are “fears” and uncertainty, but in my last year, the fear of uncertainty motivated me to apply for grants, employment, and other opportunities. I wanted to graduate with something immediately available to do, and it worked out as I followed most of the steps presented here.”*

NETWORKING

What are relevant conferences for ITD/TD researchers?

In the following, is a list of some ITD/TD conferences in 2024. However, discipline-specific conferences are starting to also offer interdisciplinary sessions, where you can promote your work in your scientific community. These sessions are often well attended by the discipline-specific researchers.

- Annual conferences organized by the [Association for Interdisciplinary Studies](#)
- 2024, 6-8th, May - [STS Conference Graz](#) - Critical Issues in Science, Technology and Society Studies.
- 2024, 4-7th, June - University of Twente, Netherlands - [EU SPRI](#) - European Forum for Studies of Policies for Research and Innovation
- 2024, 24-27 July, Bethesda, MD, USA, [Science of Team Science conference](#)
- 2024, November 4th–8th, Utrecht, Netherlands: [ITD24](#) (Inter- and Transdisciplinarity Conference).
- For a list of journals see the ITD Alliance website: <https://itd-alliance.org/resources/journals/>
- For a list of conferences also see the ITD Alliance website : <https://itd-alliance.org/resources/conferences/>

What are other relevant activities and events for ITD/TD researchers?

In the following is a list of summer and winter schools and other activities to enhance one's ITD/TD skills. Provided are links to former executions:

- [Sustainability Science Forum](#), Switzerland, organized by the Swiss Academies' Sustainability Initiative
- Summer School in Social Science Methods, Lugano, Switzerland (e.g., [2023](#))
- Autumn School Future Earth France Hub (e.g., [Sustainability science framings and practices in Europe: How do we leverage transformative research?](#) in 2023)
- tdAcademy Summer and Winter Schools (e.g., [International Summer School - Transdisciplinarity methods and tools for dealing with sustainability and land use conflicts](#) in 2023)
- [International Program on Ecosystem Change and Society \(PECS\)](#)
- [World Food System Summer School](#) [annually]
- [Citizen Science Summer School](#) [annually]

What are relevant journals for ITD/TD researchers?

In the following is a list with journals where ITD/TD research has high value. Sometimes, there are also special issues within discipline-specific journals fostering ITD/TD research, thus it is worth checking these special issues regularly.

- [Cities](#)
- [Climate action](#)
- [Current Opinion in Environmental Sustainability](#)
- [Energy Research and Social Science](#)
- [Environmental Science & Policy](#)
- [Environmental Innovation and Societal Transitions](#)
- [Ecology and Society](#)
- [European Journal of Futures Research](#)
- [GAIA](#) - Ecological Perspectives for Science and Society
- [Global Environmental Change](#)
- [Humanities and social sciences communications](#)
- [International Journal of Disaster Risk Reduction](#)
- [Policy Sciences](#)
- [Research Evaluation Research Policy](#)
- [Transportation Research Interdisciplinary Perspectives](#)

FUNDING AND PROPOSAL WRITING (CAREER OPPORTUNITIES)

What are funding opportunities for ECRs specific to ITD/TD research?

Applying for funding after completing a PhD or Postdoc involves a strategic and well-organized approach. Also, remember that the competition for funding can be intense, so one must be persistent and resilient. You should not be discouraged when the response is negative, but rather build on what you have learned in each round to refine and tailor your proposals. While for some, it may seem that they easily get funded, it may take others several tries before "making" it. Try not to compare yourself to others and focus on the work that you want to do. From our experience, although this may be slowly changing, talent-focused funding schemes are a good match for those who can carry out work that does not need collaboration across institutions or various societal actors. The nature of these proposals are not set up for transdisciplinary research. On the other hand, Horizon Europe proposals require transdisciplinary collaboration, including the involvement of SMEs and government agencies in the proposal stage, as well as stakeholder engagement as a part of the project itself. Be aware of the type of work you want to spend time doing. If it is really transdisciplinary work that interests you, then go for those schemes that allow you to do that. If what is most important for you is to "deep dive" into a topic with one or two other researchers whom you can handpick to work with, the talent funding schemes would be a better fit. Consider what kind of research appeals to you more.

Another note - please do not take a rejection to mean that your ideas are not worth pursuing. Though it is always wise to do so, read through the feedback with a grain of salt. Reviewers are often time-pressed, but also some times have insightful perspectives to offer you. Pick what is constructive for you from this feedback and leave behind the rest that does not serve you. However, resilience to sometimes negative feedback is something that would greatly help you in persisting with an academic career, though this is never easy. The proposal writing and winning process is one in which there are many elements not within your control. If you enjoy the proposal writing, keep doing it. It is worth it to invest so much time in each attempt if you get something out of the process itself. Each application is a learning opportunity that contributes to your growth as a researcher. If you do not enjoy it after trying it, and you find yourself doing it only because of a positive outcome, then perhaps ask if this is something you want to keep doing.

Here are some general steps to guide you through the process:

- 1) Identify funding opportunities
- 2) Understand application requirements
- 3) Develop a clear research proposal

*Note: If you are writing a Horizon proposal or a collaborative research grant, it is crucial to gather a consortium of people whom you can trust and know you can work with. If you have never worked with people before, it may be a good idea to have a couple of conversations with them first to make sure you are on the same page. You may also want to lean on more experienced colleagues for tips about who to involve. In collaborative projects, it is not only about winning the proposal, but making sure that you have a good chance of enjoying the work once you win the proposal so that it adds to your life rather than become a burden. The outward "shine" and appeal of winning is only meaningful if the people you must work with are behind one another.

- 4) Request letters of recommendation (if needed)

- 5) Prepare budget
- 6) Seek feedback from your peers/professors
- 7) Engage with your network to grasp the pulse of the scientific debates

In the subsequent table, a list of possible funding sources and grants are listed. Please consider that it is not an exhaustive list.

Proposals	Location	Eligibility	Amount	Note	Contact
Horizon Europe	EU (with possibilities for Associated country participation)	Open	Various, but able to fund both salary and research funds, usually lasting 3-4 years. "Research and Innovation Actions" (RIA) are especially good for providing opportunities for both basic and applied research topics.	<p>There is a big difference in being involved in one of these large cross-EU proposals as the coordinator, work package leader or a researcher carrying out the work within a work package. Becoming a coordinator takes a lot of work, but can be a way of stepping from a post-doctoral role into a group leader or PI role. If you do not have a permanent position in a university, you may also need the support of professor to underwrite the budget even if they are not themselves involved in the writing of the proposal. These schemes are especially suitable to the skill set of ITD researchers because of increasing calls for stakeholder engagement and transdisciplinary research methods.</p> <p>To get started, the best way is perhaps to find a colleague who has already had experience as a part of such a project. Even though the process seems opaque and daunting, it is a very good match for ITD researchers.</p>	https://research-and-innovation.ec.europa.eu/events/horizon-europe-info-days_en
European Research Council grants (starter, consolidator, advanced)		Different time limits from PhD graduation	Varies funds salaries of PhD, post-docs and PI	Though challenging for ITD researchers because its focus is still on fundamental or basic research, there are still possibilities for ITD research.	https://erc.europa.eu/homepage
Marie-Curie Post doctoral fellowships	EU and Global	No later than 8 years after PhD completion / European citizen	Covers living and mobility allowance, as well as research, training, and networking activities	The Postdoctoral Fellowships action targets researchers holding a PhD who wish to carry out their research activities abroad, acquire new skills, and develop their careers. PFs help researchers gain experience in other countries, disciplines, and non-academic sectors.	https://marie-sklodowska-curie-actions.ec.europa.eu/actions/postdoctoral-fellowships
European Research Council Synergy grants	Europe and Global		Can be up to a maximum of € 10 million for a period of 6 years	A group of two to maximum of four Principal Investigators (PIs) working together and bringing different skills and resources to tackle ambitious research problems. One will be designated as the corresponding PI (cPI).	https://erc.europa.eu/apply-grant/synergy-grant

Pan African University Institute	Africa	Open for Masters and PhDs	Covers tuition and Funds living expenses for masters and PhD researchers from Africa	<p>The funding covers masters and PhD students from Africa at one of the Pan African University (PAU) institutes under various thematic areas, as follows:</p> <ul style="list-style-type: none"> → Water and Energy Sciences (including Climate Change) (PAUWES, Algeria); → Basic Science, Technology and Innovation (PAUSTI, Kenya); → Life and Earth Sciences (PAULESI, Nigeria); → Governance, Humanities and Social Sciences (PAUGHSS, Cameroon); → Space Sciences (PAUSS, South Africa) 	https://pau-au.africa/admissions/scholarships
Mastercard Foundation Scholars Program	Indigenous communities in Canada and African Countries: Ethiopia, Ghana, Kenya, Nigeria, Rwanda, Senegal, Uganda	Bachelors and Masters degree	Covers tuition and basic living expenses.	The Mastercard Foundation Scholars Program envisions a transformative network of young people and institutions driving inclusive and equitable socio-economic change. It offers mentoring, leadership skills development, tutoring, internship opportunities, and career services in addition to covering tuition and basic living expenses	https://mastercardfdn.org/all/scholars/
Country specific talent programmes					
NWO - Veni, Vidi, Vici	The Netherlands	Different time limits from PhD graduation (similar to the ERC)	Researchers can apply for a maximum amount of 320,000 euros for Veni, 850,000 euros for Vidi, and 1.5 million euros for Vici.	<p>Veni is part of the NWO Talent Programme. It allows researchers who have recently obtained their PhD to conduct independent research and develop their ideas for a period of three years.</p> <p>Vidi is for researchers who have carried out several years of postdoctoral research after their Phd and have demonstrated the ability to independently generate and effect innovative ideas.</p> <p>Vici is for senior researchers who have demonstrated an ability to develop their own line of research.</p>	https://www.nwo.nl/en/calls/nwo-talent-programme
SNSF - Ambizione	Switzerland	No later than 4 years after PhD completion	Covers the grantee's salary and the funds needed to carry out the project. An Ambizione project grant, however, comprises only project	Ambizione grants are aimed at young researchers who wish to conduct, manage and lead an independent project at a Swiss higher education institution. The scheme supports young researchers both from Switzerland and abroad.	https://www.snf.ch/en/N18L3oGWomTSSGkF/funding/careers/ambizione

			funds. The grants are awarded for a maximum of four years.		
SNSF - Starting, Postdoctoral fellowships, Consolidator grants	Switzerland	No later than 8 years after PhD completion	Covers project budget and salary (if needed)	Due to Switzerland's status as a non-associated third country in the Horizon Europe programme, the federal government mandated the SNSF to launch the funding scheme "SNSF Starting Grants 2024". This integrative call is a transitional measure covering the ERC Starting Grants 2024 as well as the former SNSF funding schemes Eccellenza and PRIMA.	https://www.snf.ch/en/A7fep1IPxz1XezVS/page/find-funding-scheme?category=iZo7IDPLP4MgsILF%3B&page=0
Country specific collaborative research schemes					
NWO - Collaboration in research calls	The Netherlands	Various	-	-	https://www.nwo.nl/calls?f%5B0%5D=calls_program_financing%3A4748
SNSF - Sinergia	Switzerland	Need backing of professor	max. CHF 3.2 million	Sinergia promotes the interdisciplinary collaboration of two to four research groups that propose breakthrough research.	https://www.snf.ch/en/HzVMPWm96mz69ZJ8/funding/programmes/sinergia
Irish Research Council	The Republic of Ireland	Open	Varies, funds salaries of Masters, PhD and post-docs	The Irish Research Council (IRC) is an associate agency of the Department of Further and Higher Education, Research, Innovation and Science, under the aegis of the Higher Education Authority (HEA). The mission of the IRC is to support excellence in research talent, knowledge, and engagement. The Irish Research Council (IRC) is an associate agency of the Department of Further and Higher Education, Research, Innovation and Science, under the aegis of the Higher Education Authority (HEA). The mission of the IRC is to support excellence in research talent, knowledge, and engagement	https://research.ie/about-us/
UKRI	United Kingdom	-	-	-	Ulrike Kuchner for more information
University/Institute specific fellowships					
Delft Technology Fellowship	The Netherlands	Various (application for Assistant, Associate or Full professorship)	-	Each Fellow gets the unique opportunity to shape her own research programme at the top international level, including a start-up grant. Fellowships are awarded at Full Professor, Associate Professor and Assistant Professor level.	https://www.tudelft.nl/over-tu-delft/werken-bij-tu-delft/campagnes/delft-technology-fellowship/more-about-the-delft-technology-fellowship

<p>ETH Zurich Postdoctoral Fellowships</p>	<p>Switzerland</p>	<p>Applicants must hold a doctorate (PhD) or will complete their doctorate within the next six months.</p> <p>Applicants with the doctorate (PhD) must have obtained it a maximum of two years prior to the submission deadline.</p>	<p>The duration of an ETH Fellowship is two years</p>	<p>The programme is intended to foster young researchers who have already demonstrated scientific excellence in the early stages of their careers. This prestigious early career programme is geared towards high potential academics with 40-50% of the fellows securing a professorship within a few years after the fellowship.</p>	<p>https://ethz.ch/en/research-promotion/eth-fellowships.html</p>
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